

CPC**COOPERATIVE PATENT CLASSIFICATION****F01P**

COOLING OF MACHINES OR ENGINES IN GENERAL; COOLING OF INTERNAL-COMBUSTION ENGINES (arrangements in connection with cooling of propulsion units in vehicles [B60K 11/00](#); heat-transfer, heat-exchange or heat-storage materials [C09K 5/00](#); {cooling of gas-turbine engines [F02C 7/12](#)}; heat exchange in general, radiators [F28](#))

NOTE

In this subclass, the following terms or expressions are used with the meanings indicated:

- "air" also includes other gaseous cooling fluids;
- "liquid cooling" also includes cooling where liquid is used as the heat transferring fluid between parts to be cooled and the air, e.g. using radiators;
- "air cooling" means direct air cooling and thus excludes indirect air cooling occurring in liquid cooling systems as explained herefore;
- "cooling-air" includes directly or indirectly acting cooling-air.

Attention is drawn to the notes preceding class [F01](#), especially as regards Note (3).

Cooling by lubricant is classified in subclass [F01M](#) when the lubrication aspect predominates and in subclass [F01P](#) when the cooling aspect predominates.

Air cooling; Liquid cooling (propelling cooling-air or liquid coolants [F01P 5/00](#); controlling supply or circulation of coolants [F01P 7/00](#); cylinders, pistons, valves, fuel injectors, sparking-plugs, or other engine or machine parts, modified to facilitate cooling, see the relevant classes for such parts)

F01P 1/00**Air cooling****F01P 1/02**

- . Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders

F01P 1/04

- . Arrangements for cooling pistons

F01P 1/06

- . Arrangements for cooling other engine or machine parts

F01P 1/08

- .. for cooling intake or exhaust valves

F01P 1/10

- .. for cooling fuel injectors or sparking-plugs

F01P 3/00**Liquid cooling****F01P 3/02**

- . Arrangements for cooling cylinders or cylinder heads

F01P 3/04

- .. Liquid-to-air heat-exchangers combined with, or arranged on, cylinders or cylinder heads

- F01P 3/06 . Arrangements for cooling pistons
- F01P 3/08 .. Cooling of piston exterior only, e.g. by jets
- F01P 3/10 .. Cooling by flow of coolant through pistons

- F01P 3/12 . Arrangements for cooling other engine or machine parts
- F01P 3/14 .. for cooling intake or exhaust valves
- F01P 3/16 .. for cooling fuel injectors or sparking-plugs

- F01P 3/18 . Arrangements or mounting of liquid-to-air heat-exchangers (such arrangements on cylinders or cylinder heads [F01P 3/04](#); relative to vehicles [B60K 11/04](#))

- F01P 3/20 . Cooling circuits not specific to a single part of engine or machine ([F01P 3/22](#) takes precedence)
- F01P 3/202 .. {for outboard marine engines}
- F01P 3/205 ... {Flushing}
- F01P 3/207 .. {liquid-to-liquid heat-exchanging relative to marine vessels}

- F01P 3/22 . characterised by evaporation and condensation of coolant in closed cycles (other cooling by evaporation [F01P 9/02](#)); characterised by the coolant reaching higher temperatures than normal atmospheric boiling-point
- F01P 3/2207 .. {characterised by the coolant reaching temperatures higher than the normal atmospheric boiling point}
- F01P 3/2271 .. {Closed cycles with separator and liquid return}
- F01P 3/2285 .. {Closed cycles with condenser and feed pump}

Pumping cooling-air or liquid coolants; Controlling circulation or supply of coolants

- F01P 5/00** **Pumping cooling-air or liquid coolants** (controlling circulation or supply of coolants by influencing drive of pumps [F01P 7/00](#))

- F01P 5/02 . Pumping cooling-air; Arrangements of cooling-air pumps, e.g. fans or blowers
- F01P 5/04 .. Pump-driving arrangements
- F01P 5/043 ... {Pump reversing arrangements}
- F01P 5/06 .. Guiding or ducting air to, or from, ducted fans
- F01P 5/08 .. Use of engine exhaust gases for pumping cooling-air

- F01P 5/10 . Pumping liquid coolant; Arrangements of coolant pumps
- F01P 5/12 .. Pump-driving arrangements

- F01P 5/14 . Safety means against, or active at, failure of coolant-pump drives, e.g. shutting engine down; Means for indicating functioning of coolant pump

- F01P 7/00** **Controlling of coolant flow**

- F01P 7/02 . the coolant being cooling-air

- F01P 7/023 .. {Cowlings for airplane engines}
- F01P 7/026 .. {Thermostatic control}
- F01P 7/04 .. by varying pump speed, e.g. by changing pump-drive gear ratio
- F01P 7/042 ... {using fluid couplings (couplings or clutches of this type per se [F16D 35/00](#))}
- F01P 7/044 ... {using hydraulic drives}
- F01P 7/046 ... {using mechanical drives}
- F01P 7/048 ... {using electrical drives}
- F01P 7/06 .. by varying blade pitch
- F01P 7/08 .. by cutting in or out of pumps
- F01P 7/081 ... {using clutches, e.g. electro-magnetic or induction clutches}
- F01P 7/082 {using friction clutches}
- F01P 7/084 {actuated electromagnetically}
- F01P 7/085 {actuated by fluid pressure}
- F01P 7/087 {actuated directly by deformation of a thermostatic device}
- F01P 7/088 {actuated in response to driving speed, e.g. by centrifugal devices}
- F01P 7/10 .. by throttling amount of air flowing through liquid-to-air heat exchangers
- F01P 7/12 ... by thermostatic control

- F01P 7/14 . the coolant being liquid
- F01P 7/16 .. by thermostatic control
- F01P 7/161 ... {by bypassing pumps}
- F01P 7/162 ... {by cutting in and out of pumps}
- F01P 7/164 ... {by varying pump speed}
- F01P 7/165 ... {characterised by systems with two or more loops}
- F01P 7/167 ... {by adjusting the pre-set temperature according to engine parameters, e.g. engine load, engine speed}

- F01P 9/00** **Cooling having pertinent characteristics not provided for in, or of interest apart from, groups [F01P 1/00](#) to [F01P 7/00](#)(profiting from waste heat of combustion-engine cooling [F02G 5/00](#))**

- F01P 9/02 . Cooling by evaporation, e.g. by spraying water on to cylinders ([evaporation and condensation of liquid coolant in closed cycles F01P 3/22](#); {[evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions B01B 1/005](#)})
- F01P 9/04 . by simultaneous or alternative use of direct air-cooling and liquid cooling ([F01P 9/02](#) takes precedence)
- F01P 9/06 . by use of refrigerating apparatus, e.g. of compressor or absorber type

- F01P 11/00** **Component parts, details, or accessories not provided for in, or of interest apart from, groups [F01P 1/00](#) to [F01P 9/00](#)**

- F01P 11/02 . Liquid-coolant {filling}, overflow, venting, or draining devices ([automatic draining during freezing conditions F01P 11/20](#))

- F01P 11/0204 .. {Filling}
- F01P 11/0209 ... {Closure caps}
- F01P 11/0214 {Mounting}
- F01P 11/0238 {with overpressure valves or vent valves}
- F01P 11/0247 {Safety; Locking against opening}
- F01P 11/0276 .. {Draining or purging}
- F01P 11/028 .. {Deaeration devices}
- F01P 11/0285 .. {Venting devices}
- F01P 11/029 .. {Expansion reservoirs}
- F01P 11/0295 .. {Condensers for radiators}

- F01P 11/04 . Arrangements of liquid pipes or hoses
- F01P 11/06 . Cleaning (in general [B08B](#)); Combating corrosion (in general [C23F](#))
- F01P 11/08 . Arrangements of lubricant coolers (in lubrication apparatus [F01M](#))
- F01P 11/10 . Guiding or ducting cooling-air, to, or from, liquid-to-air heat exchangers
- F01P 11/12 . Filtering, cooling, or silencing cooling-air
- F01P 11/14 . Indicating devices; Other safety devices
- F01P 11/16 .. concerning coolant temperature ([F01P 11/20](#) takes precedence)
- F01P 11/18 .. concerning coolant pressure, coolant flow, or liquid-coolant level
- F01P 11/20 .. concerning atmospheric freezing conditions, e.g. automatically draining or heating during frosty weather

- F01P 2001/00 Air cooling**
- F01P 2001/005 . Cooling engine rooms
- F01P 2001/02 . Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders
- F01P 2001/023 .. Cooling cylinders ([F01P 2003/022](#) takes precedence)
- F01P 2001/026 .. Cooling cylinder heads ([F01P 2003/025](#) takes precedence)

- F01P 2003/00 Liquid cooling**
- F01P 2003/001 . Cooling liquid
- F01P 2003/003 .. having boiling-point higher than 100°C
- F01P 2003/005 . the liquid being fuel
- F01P 2003/006 . the liquid being oil

- F01P 2003/008 . the liquid being water and oil
- F01P 2003/02 . Arrangements for cooling cylinders or cylinder heads
- F01P 2003/021 .. Cooling cylinders
- F01P 2003/022 ... combined with air cooling
- F01P 2003/024 .. Cooling cylinder heads
- F01P 2003/025 ... combined with air cooling
- F01P 2003/027 .. Cooling cylinders and cylinder heads in parallel
- F01P 2003/028 .. Cooling cylinders and cylinder heads in series
- F01P 2003/18 . Arrangements or mounting of liquid-to-air heat-exchangers (such arrangements on cylinders or cylinder heads [F01P 3/04](#); relative to vehicles [B60K 11/04](#))
- F01P 2003/182 .. with multiple heat-exchangers
- F01P 2003/185 .. arranged in parallel
- F01P 2003/187 .. arranged in series
- F01P 2003/22 . characterised by evaporation and condensation of coolant in closed cycles (other cooling by evaporation [F01P 9/02](#)); characterised by the coolant reaching higher temperatures than normal atmospheric boiling-point
- F01P 2003/2214 .. Condensers
- F01P 2003/2221 ... of the horizontal type
- F01P 2003/2228 ... of the upflow type
- F01P 2003/2235 ... of the downflow type
- F01P 2003/2242 ... Steam-to-steam condensers
- F01P 2003/225 ... Steam-to-liquid condensers
- F01P 2003/2257 ... Rotating condensers
- F01P 2003/2264 ... Separators
- F01P 2003/2278 .. Heat pipes
- F01P 2003/2292 .. with thermostatically controlled by-pass
- F01P 2005/00** **Pumping cooling-air or liquid coolants** (controlling circulation or supply of coolants by influencing drive of pumps [F01P 7/00](#))
- F01P 2005/02 . Pumping cooling-air; Arrangements of cooling-air pumps, e.g. fans or blowers
- F01P 2005/025 .. using two or more air pumps
- F01P 2005/04 .. Pump-driving arrangements
- F01P 2005/046 ... with electrical pump drive
- F01P 2005/10 . Pumping liquid coolant; Arrangements of coolant pumps
- F01P 2005/105 .. Using two or more pumps
- F01P 2005/12 .. Pump-driving arrangements
- F01P 2005/125 ... Driving auxiliary pumps electrically
- F01P 2007/00** **Controlling of coolant flow**

- F01P 2007/14 . the coolant being liquid
- [F01P 2007/143](#) .. using restrictions
- [F01P 2007/146](#) .. using valves
- F01P 2007/16 .. by thermostatic control
- [F01P 2007/168](#) ... By varying the cooling capacity of a liquid-to-air heat-exchanger

- F01P 2009/00** **Cooling having pertinent characteristics not provided for in, or of interest apart from, groups [F01P 1/00](#) to [F01P 7/00](#)(profiting from waste heat of combustion-engine cooling [F02G 5/00](#))**

- [F01P 2009/005](#) . Cooling with melting solids

- F01P 2011/00** **Component parts, details, or accessories not provided for in, or of interest apart from, groups [F01P 1/00](#) to [F01P 9/00](#)**

- F01P 2011/02 . Liquid-coolant {filling}, overflow, venting, or draining devices ([automatic draining during freezing conditions F01P 11/20](#))
- F01P 2011/0204 .. {Filling}
- F01P 2011/0209 ... {Closure caps}
- F01P 2011/0214 {Mounting}
- [F01P 2011/0219](#) using bayonet connections
- [F01P 2011/0223](#) Decoration
- [F01P 2011/0228](#) Sealing
- [F01P 2011/0233](#) Venting
- F01P 2011/0238 {with overpressure valves or vent valves}
- [F01P 2011/0242](#) setting the pressure valve
- F01P 2011/0247 {Safety; Locking against opening}
- [F01P 2011/0252](#) Venting before opening
- [F01P 2011/0257](#) with theft preventing means
- [F01P 2011/0261](#) activated by temperature
- [F01P 2011/0266](#) activated by pressure
- [F01P 2011/0271](#) Semi-permeable, e.g. using Gore-Tex c fibres

- F01P 2011/06 . Cleaning ([in general B08B](#)); Combating corrosion ([in general C23F](#))
- [F01P 2011/061](#) .. Cleaning or combatting corrosion using filters
- [F01P 2011/063](#) .. Cleaning ([F01P 2011/061 takes precedence](#))
- [F01P 2011/065](#) .. Flushing
- [F01P 2011/066](#) .. Combating corrosion ([F01P 2011/061 takes precedence](#))
- [F01P 2011/068](#) ... chemically

- F01P 2011/14 . Indicating devices; Other safety devices
- [F01P 2011/205](#) .. using heat-accumulators

F01P 2023/00 **Signal processing; Details thereof**

F01P 2023/08 . Microprocessor; Microcomputer

Air cooling; Liquid cooling (propelling cooling-air or liquid coolants [F01P 5/00](#); controlling supply or circulation of coolants [F01P 7/00](#); cylinders, pistons, valves, fuel injectors, sparking-plugs, or other engine or machine parts, modified to facilitate cooling, see the relevant classes for such parts)

F01P 2025/00 **Measuring**

F01P 2025/04 . Pressure

F01P 2025/06 .. for determining flow

F01P 2025/08 . Temperature

F01P 2025/12 .. Cabin temperature

F01P 2025/13 .. Ambient temperature

F01P 2025/30 .. Engine incoming fluid temperature

F01P 2025/31 .. Cylinder temperature

F01P 2025/32 .. Engine outgoing fluid temperature

F01P 2025/33 .. Cylinder head temperature

F01P 2025/34 .. Heat exchanger incoming fluid temperature

F01P 2025/36 .. Heat exchanger mixed fluid temperature

F01P 2025/40 .. Oil temperature

F01P 2025/42 .. Intake manifold temperature

F01P 2025/44 .. Outlet manifold temperature

F01P 2025/46 .. Engine parts temperature

F01P 2025/48 .. Engine room temperature

F01P 2025/50 .. using two or more temperature sensors

F01P 2025/52 .. Heat exchanger temperature

F01P 2025/60 . Operating parameters

F01P 2025/62 .. Load

F01P 2025/64 .. Number of revolutions

F01P 2025/66 .. Vehicle speed

F01P 2025/70 . Level

F01P 2025/80 . Concentration anti-freeze

F01P 2031/00 **Fail safe**

F01P 2031/16 . using melting materials

- F01P 2031/18 . Detecting fluid leaks
- F01P 2031/20 . Warning devices
- F01P 2031/22 . using warning lamps
- F01P 2031/24 . for freezing
- F01P 2031/30 . Cooling after the engine is stopped
- F01P 2031/32 . Deblocking of damaged thermostat
- F01P 2031/34 . Limping home
- F01P 2031/36 . Failure of coolant pump

F01P 2037/00 Controlling

- F01P 2037/02 . starting

F01P 2050/00 Applications

- F01P 2050/02 . Marine engines
- F01P 2050/04 . . using direct cooling
- F01P 2050/06 . . using liquid-to-liquid heat exchangers
- F01P 2050/08 . . Engine room
- F01P 2050/10 . . Z-type engine
- F01P 2050/12 . . Outboard engine
- F01P 2050/16 . Motor-cycles
- F01P 2050/20 . Aircraft engines
- F01P 2050/22 . Motor-cars
- F01P 2050/24 . Hybrid vehicles
- F01P 2050/30 . Circuit boards

F01P 2060/00 Cooling circuits using auxiliaries

- F01P 2060/02 . Intercooler
- F01P 2060/04 . Lubricant cooler
- F01P 2060/045 . . for transmissions
- F01P 2060/06 . Retarder

- F01P 2060/08 . Cabin heater
- F01P 2060/10 . Fuel manifold
- F01P 2060/12 . Turbo charger
- F01P 2060/14 . Condenser
- F01P 2060/16 . Outlet manifold
- F01P 2060/18 . Heater
- F01P 2060/185 . . for alternators or generators

F01P 2070/00 Details

- F01P 2070/02 . using shape memory alloys
- F01P 2070/04 . using electrical heating elements
- F01P 2070/06 . Using intake pressure as actuating fluid
- F01P 2070/08 . Using lubricant pressure as actuating fluid
- F01P 2070/10 . using electrical or electromechanical means
- F01P 2070/30 . Rotating radiators
- F01P 2070/32 . Ring-shaped heat exchangers
- F01P 2070/50 . mounting fans to heat-exchangers
- F01P 2070/52 . mounting heat-exchangers